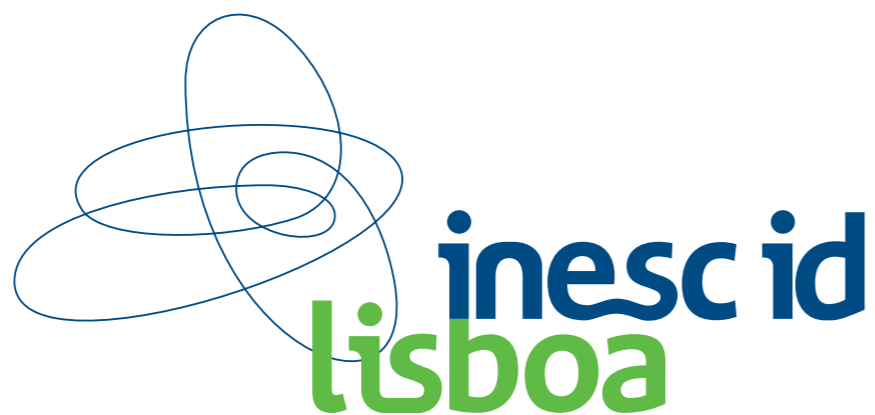


Self-Tuning Intel TSX

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HTDC 2014

PhD Thesis: Protocols and Abstractions for Efficient Transactional Systems

- Reduce aborts
 - preserving consistency
 - shared memory / distributed
- Efficient transactional indexation/search
- Energy-efficiency of TM systems
- More recently: how can we leverage on hardware for efficient transactional systems

Using TSX

```
_xbegin
```

```
// your transactional code
```

```
_xend
```

Using TSX

```
_xbegin
```

```
// your transactional code
```

```
_xend
```



May Abort

Using TSX

```
_xbegin
```

```
// your transactional code
```

```
_xend
```



May Abort

- Data contention
- Forbidden instructions
- Hardware buffers' capacity
- Signals and faults

Using TSX

```
_xbegin  
// your transactional code  
_xend
```



May Abort

**Transparently
Restarts**

- Data contention
- Forbidden instructions
- Hardware buffers' capacity
- Signals and faults

Using TSX

**Best-effort nature
we cannot rely exclusively on TSX**

Best-effort nature

Not **that** specific
to Intel TSX.
IBM HTMs apply
partly here too

Best-effort nature

```
begin:
unsigned int status = _xbegin
if (status == ok) goto code
// retry policy
if (shouldRetry)
    goto begin
else
    acquire(lock)

code:
// your transactional code

if (shouldRetry)
    _xend
else
    release(lock)
```

Not *that* specific
to Intel TSX.
IBM HTMs apply
partly here too

Best-effort nature

```
begin:  
unsigned int status = _xbegin  
if (status == ok) goto code  
// retry policy  
if (shouldRetry)  
    goto begin  
else  
    acquire(lock)
```

```
code:  
// your transactional code  
  
if (shouldRetry)  
    _xend  
else  
    release(lock)
```

Not *that* specific
to Intel TSX.
IBM HTMs apply
partly here too

Transactions need
to be aware of this

Summary of issues

- Lemming effect
- Number of attempts
- Retry policy
- Management of fall-back

Abort Code	
retry	Transient Failure
conflict	Contention to Data
capacity	Exceeded Cache Capacity
explicit	_xabort invoked
other	...

Lemming Effect

```
begin:
```

```
wait lock is free
```

```
unsigned int status = _xbegin
```

```
if (status == ok) goto code
```

```
// retry policy
```

```
if (shouldRetry)
```

```
    goto begin
```

```
else
```

```
    acquire(lock)
```

```
...
```

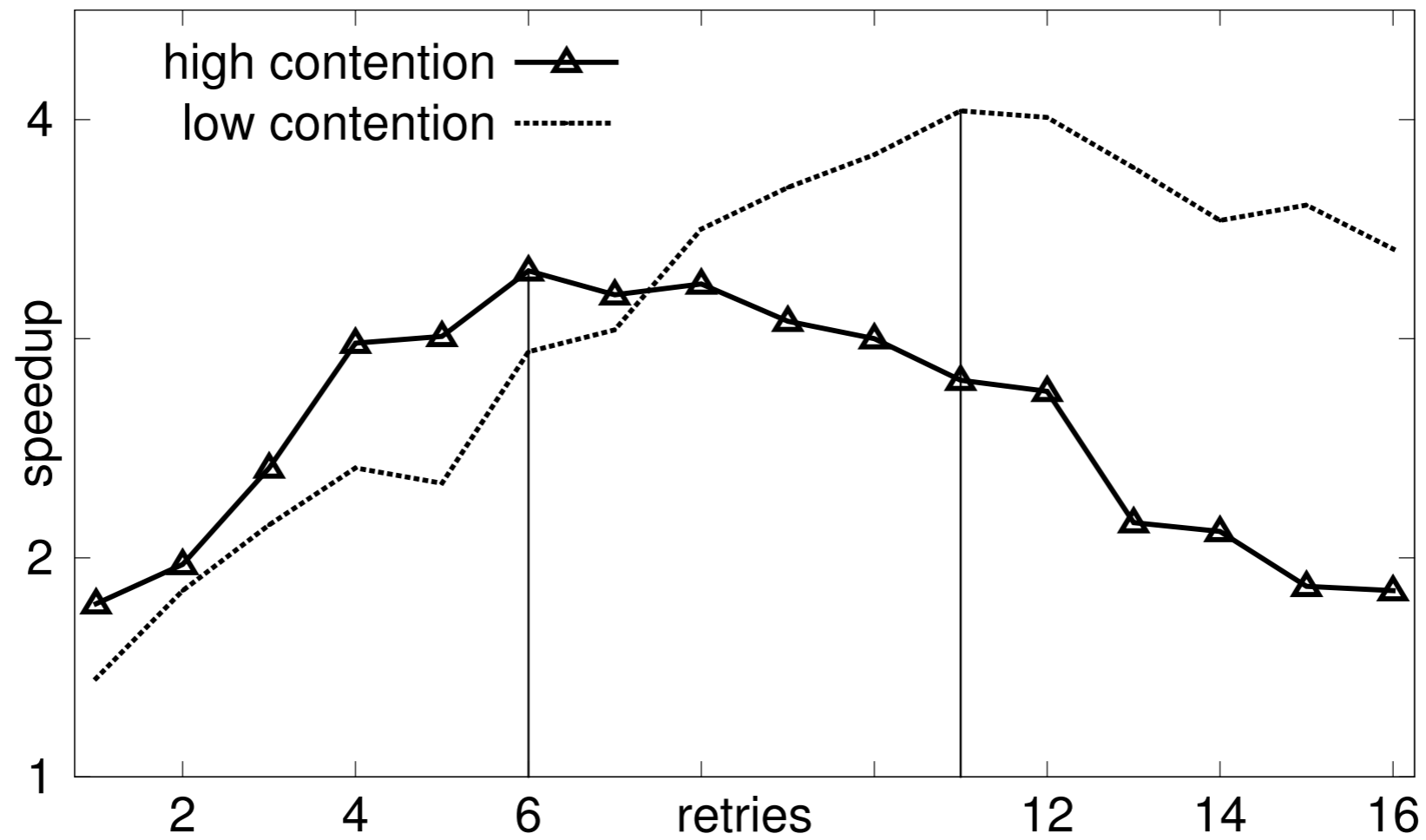
or

Programming with HLE

Afek et al. PPOPP 2013

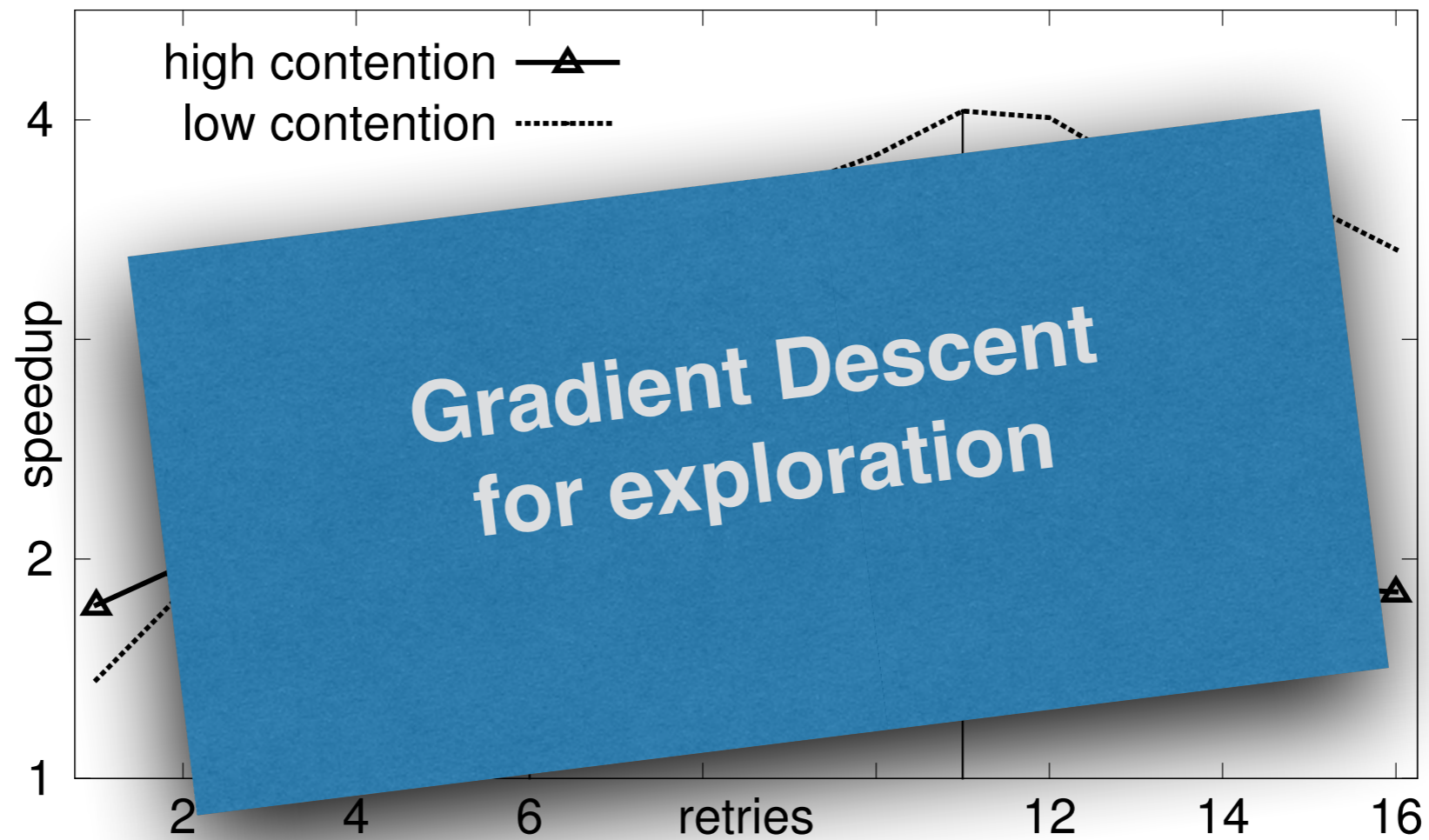
Number of attempts

Kmeans from STAMP



Number of attempts

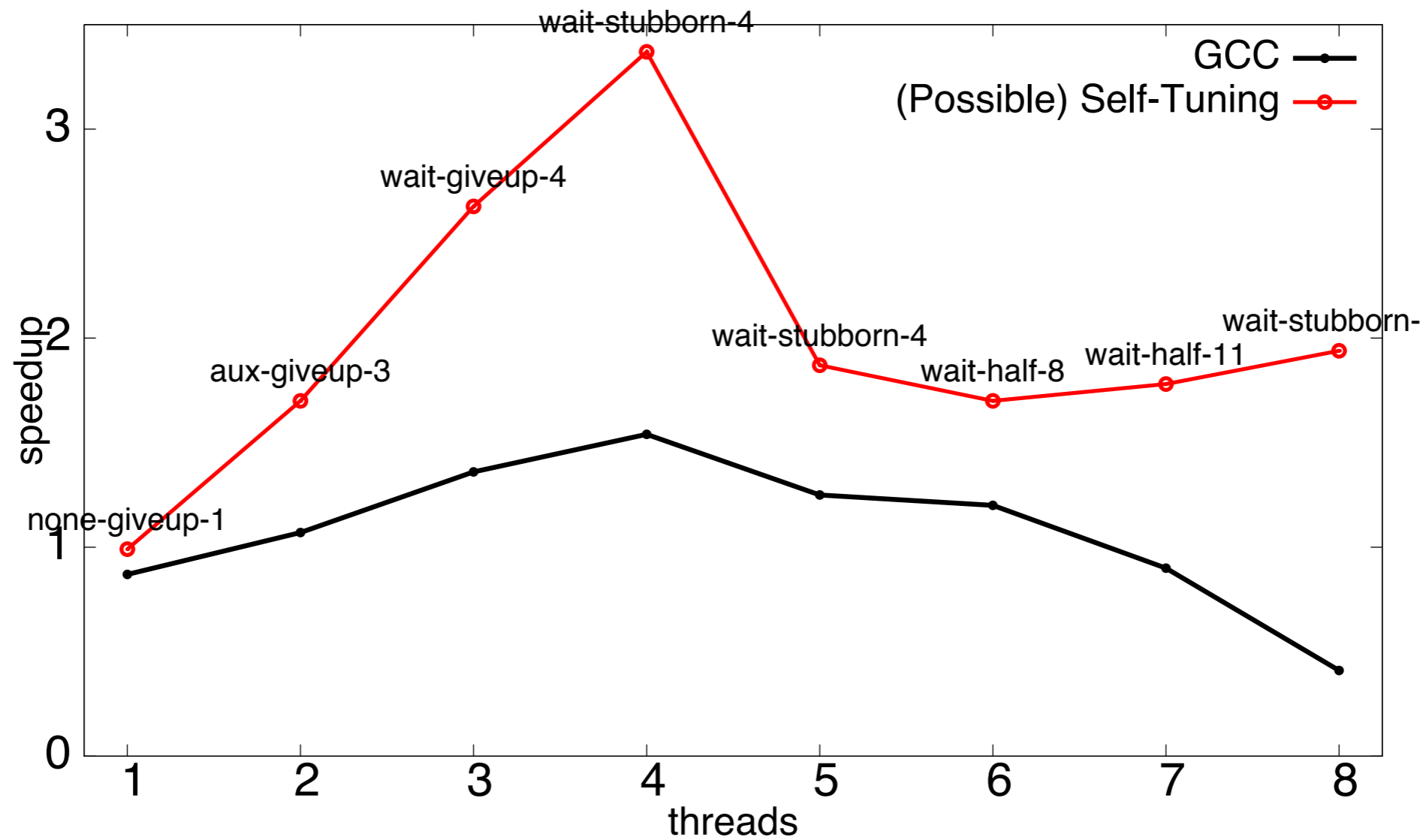
Kmeans from STAMP



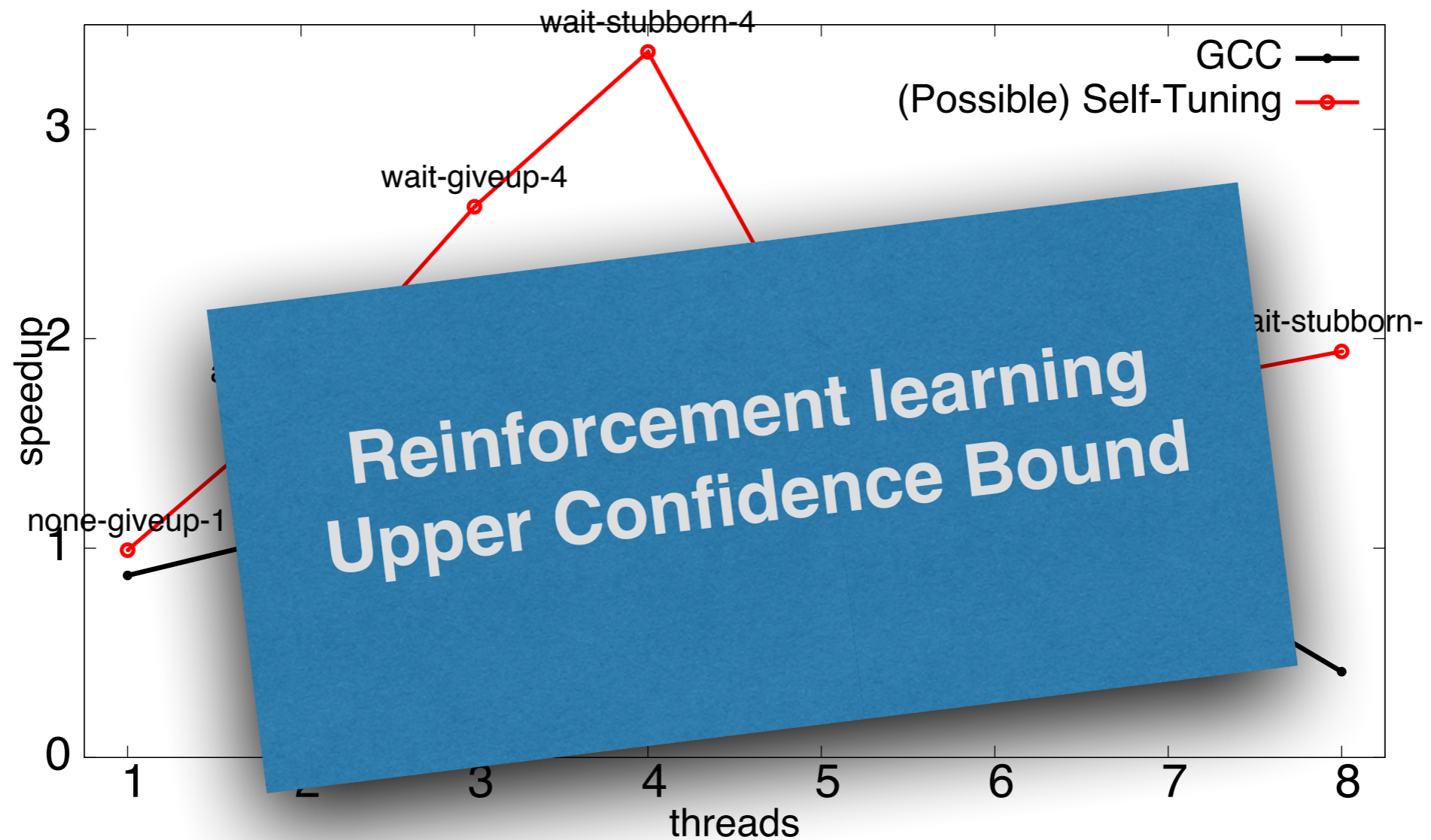
Retry policy

- How many attempts in hardware?
- Give up on capacity aborts?
- How to manage the fall-back?

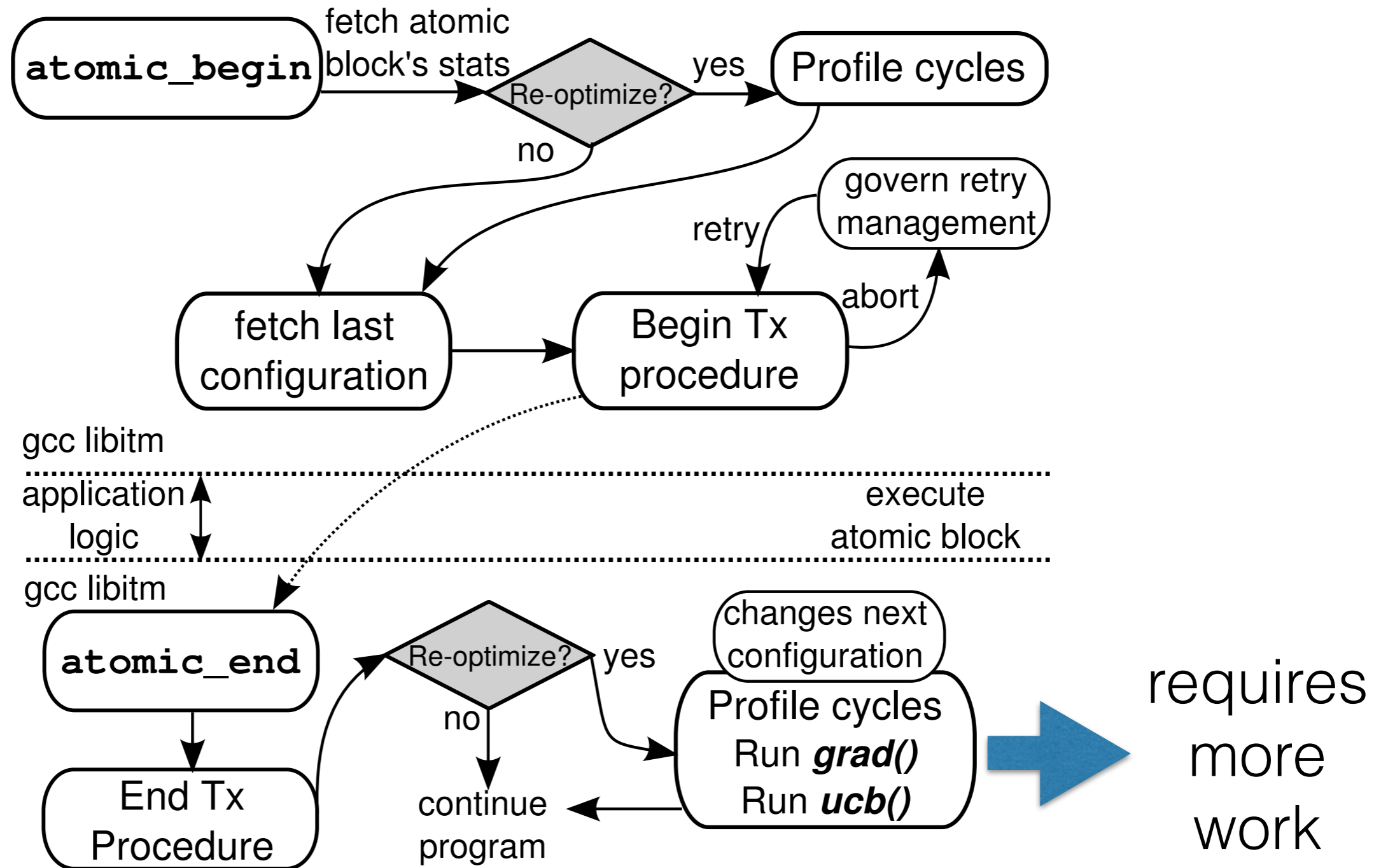
Retry policy



Retry policy

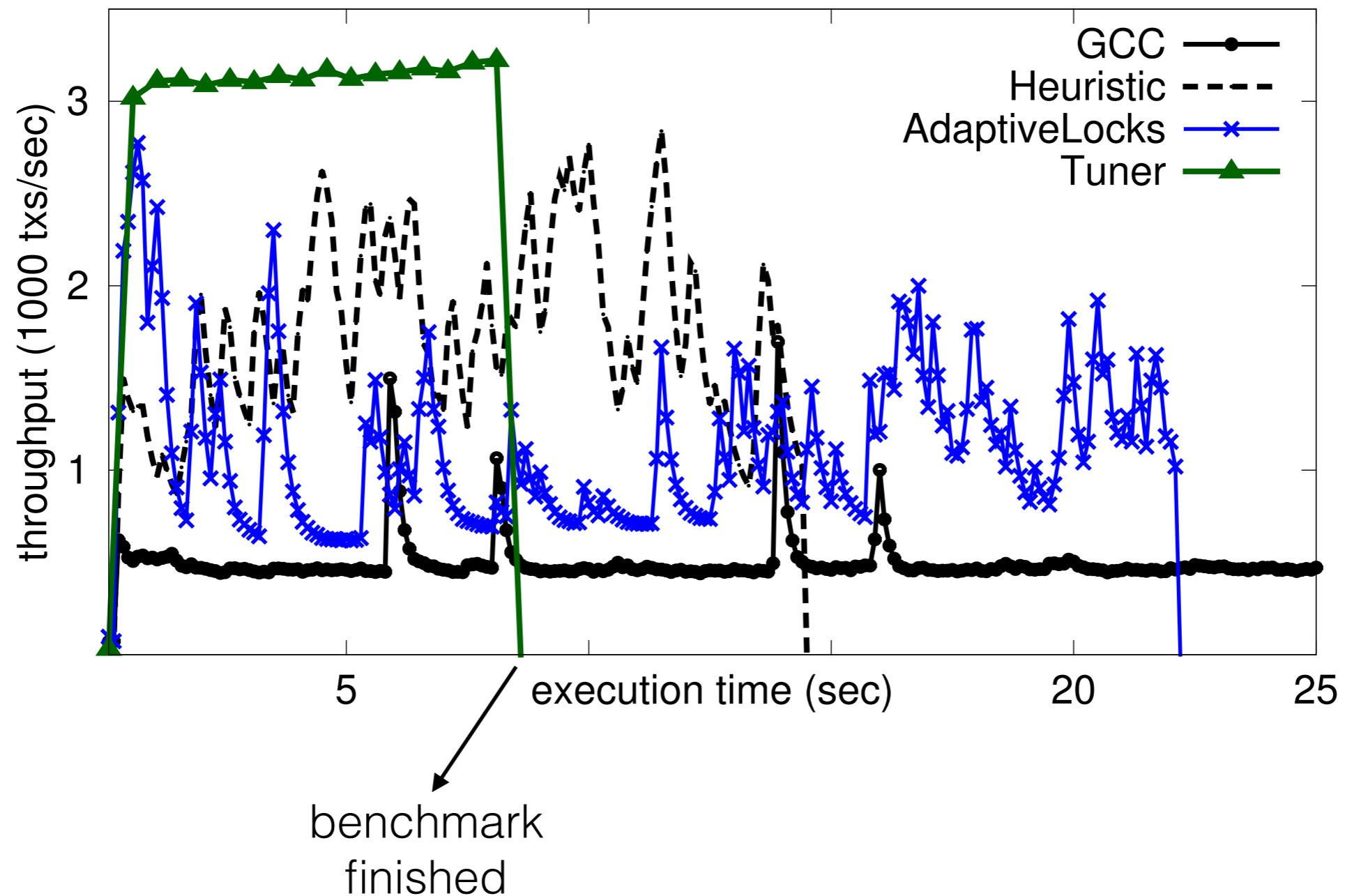


Self-Tuning TSX



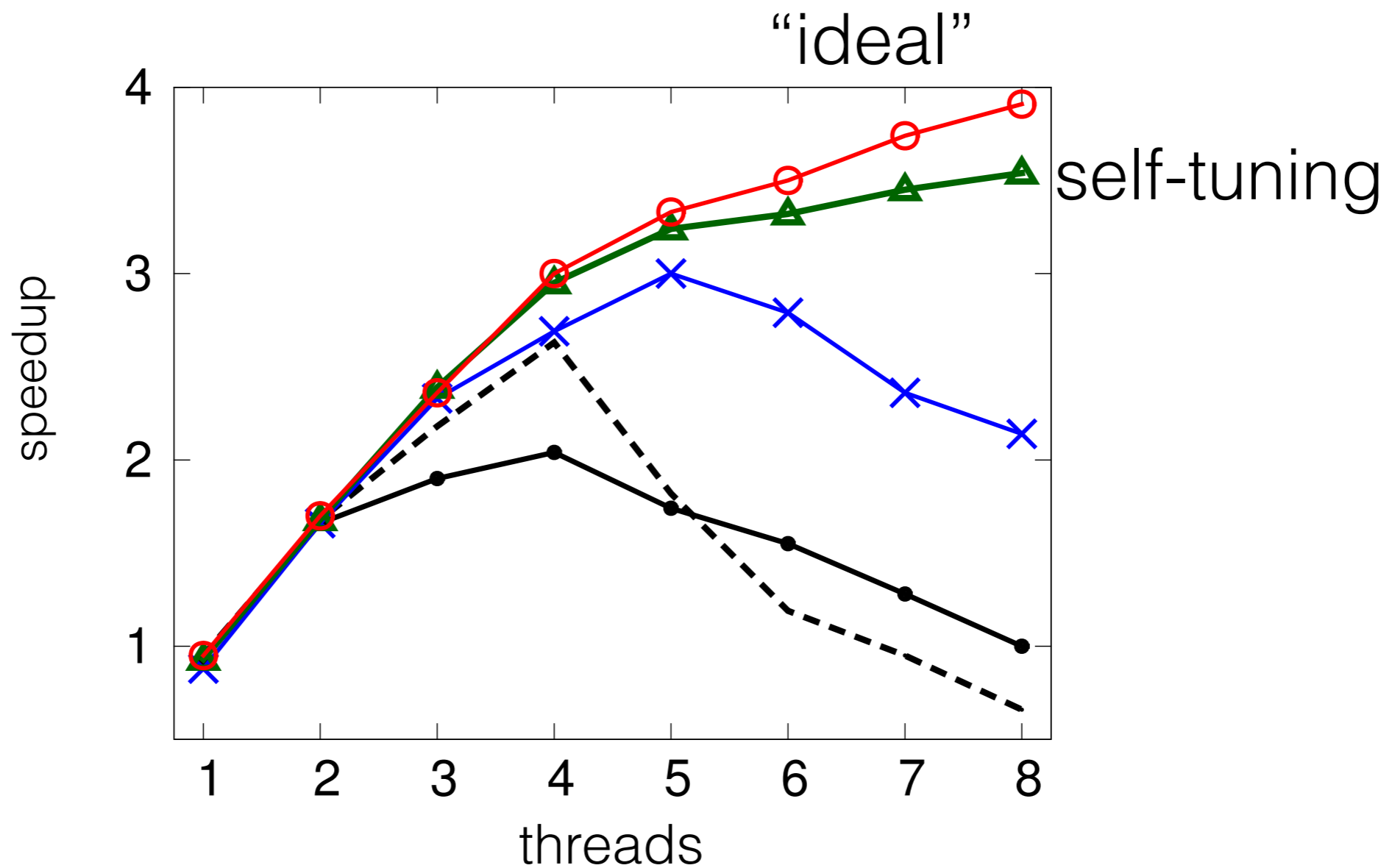
Quick flavour on results

Yada from STAMP



Quick flavour on results

Intruder from STAMP



Summary

- Best-effort HTMs need proper tuning
- No one-size fits all
- We used lightweight exploration/learning techniques
- Transparent to the programmer